Call Processing Time Analysis for the Town of Cary's Communications Center

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Certification Statement

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Abstract

The call processing times of the Town of Cary’s Emergency Communications Center (ECC), which dispatches calls for the Cary Fire Department, exceed the criteria of the Commission on Fire Accreditation International (CFAI) and the call processing goal adopted by the Cary Town Council. This results in a longer total response time for emergency incidents. The purpose of this research was to conduct an analysis of the current call processing time performance to identify areas for improvement. The research questions are: (a) to what extent do call processing times exceed applicable standards and the approved goal, (b) to what extent do the current processes contribute to extending call processing times, (c) to what extent does current technology contribute to extending call processing times, (d) to what extent do behavioral factors contribute to extending call processing times, and (e) how can call processing times be improved. An evaluative research method was utilized to evaluate the current call processing data. The processes, technology, and behavioral factors were evaluated using data analysis, literature review, and a questionnaire to determine to what extent these factors contribute to extended call processing times. The ECC is not meeting national consensus standards and exceeds the CFAI recommendation and approved goal by 22 seconds for processing of all calls. However, the data is consistent with the findings in the 2010 “Quantitative Evaluation of Fire and EMS Mobilization” final report by Upson and Notarianni. The ECC is well equipped with the latest technology and is commensurate with centers serving jurisdictions of similar size and demographics. It is recommended that the Cary Fire Department educate the ECC staff about the national consensus standards, CFAI recommendation, and performance expectations for the

center in regard to call processing and conduct additional research on call processing times that involve data transfer and wireless calls.

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The call processing times of the Town of Cary's Communications Center, which dispatches calls for the Cary Fire Department, exceed the criteria of the Commission on Fire Accreditation International (CFAI) and the call processing goal adopted by the Cary Town Council. This results in a longer total response time for emergency incidents.

The primary purpose of the CFAI is to assist agencies in enhancing service delivery through continuous improvement (CFAI, 2006). One of the chief performance objectives that fire departments attempt to improve is total response time, which includes call processing time, turnout time, and travel time. If they are to save lives and limit property damage, emergency response companies must arrive within a short period of time with sufficient resources to do the job (CFAI, 2008).

The purpose of this research is to conduct an analysis of the current call processing time performance to identify areas for improvement. The research questions are: (a) to what extent do call processing times exceed applicable standards and the approved goal, (b) to what extent do the current processes contribute to extending call processing times, (c) to what extent does current technology contribute to extending call processing times, (d) to what extent do behavioral factors contribute to extending call processing times, and (e) how can call processing times be improved.

An evaluative research method will be utilized to evaluate the current call processing data. The current processes, technology, and behavioral factors will be evaluated using data analysis, literature review, and a questionnaire to determine to what extent these factors contribute to extended call processing times.

Background and Significance

The Town of Cary Fire Department's current Standard of Response Coverage document (2010), which is maintained as part of the department's CFAI accreditation, details the history of the Town and of the department based on historical research. The following background information is a summary of the history contained in that document.

The Town of Cary is a thriving community in Wake County, North Carolina, which is located in the heart of an area referred to as the Triangle. The Town of Cary is situated between Raleigh, the state capital, and the world renowned Research Triangle Park.

Chartered by the North Carolina General Assembly on April 6, 1871, the Town of Cary is one of more than 525 municipal corporations in the state of North Carolina. Governed by a Council-Manager form of administration as provided for in the North Carolina General Statutes, the powers and authority of the municipal government are spelled out in state law, and Cary may do no more than is authorized by that body of law. The Fire Department has been legally established under North Carolina General Statutes Article 14, Fire Protection, Chapter 160A-291, and organized within the Town's charter, also known as the Code of Ordinances, in Chapter 16 Section 16-19 (Town of Cary Code of Ordinances, 2010).

The first documentation on the origin of the Cary Fire Department is found in the Town Council minutes dated June 8, 1920, which state that arrangements were made for the Raleigh Fire Department to respond to any fire alarm with the Town of Cary limits.

In 1921, the first fire inspector for Cary was appointed to ensure compliance with state laws. L.A. Cathy was appointed by the Town Alderman to organize a fire company for the Town. The first fire truck was purchased, along with a metal garage to serve as the first fire station. Mr. H.H. Waddell served as the first Fire Chief.

Through the period of 1930 to 1960, the department continued to function on a volunteer basis with support from the Town and annual fund-raisers for the purchase of apparatus and equipment. On November 1, 1954, The Cary Rural Fire Department was incorporated. The Fire Department at that time had 21 volunteers and continued to function as a volunteer department until 1960.

In 1960, the Town established its own Fire Department. This was a volunteer group to work under the direction of a paid chief. The department was split into two entities: a newly created Town of Cary Fire Department and the Cary Rural Fire Department (YRAC). The Town hired two “paid firemen” in order to have one fireman on duty in Town at all times. YRAC was organized by former Rural Cary Fire Department volunteers to respond to calls outside the Town limits. By 1982, volunteer firefighters were phased out.

The current Town of Cary Fire Department Business/Strategic Plan, which is maintained as part of CFAI accreditation and is required by the Cary Town Manager, describes the functions and operations of the Fire Department, and the information in the following section is based on this document.

The Cary Fire Department is organized into three business activities: 1) Operations, which includes Training and Risk Management; 2) Logistics; and 3) Budget and Planning. The Cary Fire/Rescue Department provides fire suppression, first responder emergency medical service, and technical rescue within the Town's corporate limits and provides mutual aid with surrounding departments. The Operations Group is divided into suppression staff, the Risk Management Group, and the Training/Safety Group. The suppression staff is organized into three rotating shifts that provide 24-hour coverage to the citizens of Cary. They operate from seven strategically located fire stations and participate with North Carolina Task Force 8, which is one of five Type I Urban Search and Rescue Teams in the state. The Risk Management Group enforces the North Carolina Fire Prevention Code (International Fire Code), Town of Cary Standard Specifications and Details, and referenced NFPA standards. The Training/Safety Group manages the training programs for the Operations Division, including state-mandated training in firefighting, rescue technician, hazardous materials, incident command, and emergency medical technician/defibrillation (EMT), and also manages all health and safety issues arising from policies and processes.

The Town of Cary Fire/Rescue Department has 209 full-time employees who serve a population of more than 141,000 over a 55-square-mile area, reflecting a population growth of more than 47.85% since the 2000 census. For fiscal year 2011, the annual budget was $17,852,717, and the department responded to more than 7,000 fire and first responder calls.

According to U.S. Census figures, Cary's population has doubled every 10 years since the 1960s, growing by more than 90,000 people over the past four decades. By 2000, Cary was the seventh largest city in North Carolina — larger than Wilmington, Asheville, and High Point. Using the population criteria from CFAI (2008), the Town is classified as an urban area.

In 1999, the Town of Cary Fire/Rescue Department became an Internationally Accredited Agency through CFAI. The department was re-accredited in 2004 and in August 2010. The department’s most recent North Carolina Insurance Services Office grading occurred in February 2010 and resulted in an ISO rating of Class 3.

The Fire Department was responsible for dispatching Fire Department resources to emergencies until the late 1970s. During this time, the Fire Department either received calls for service directly at Fire Station 1 or they were transferred from Raleigh/Wake 911.

In 1979, Cary was the first Wake County community to get 911 emergency telephone service, at which time dispatching fire resources was moved from Cary Fire Station 1 to the Cary’s Emergency Communications Center (ECC), also known as the 911 center.

Ed Spahn, former Orange County, FL, Fire Official and Deputy Chief, and president and owner of Fire Protection Engineering Co., underscores the considerations when deciding which entity should handle emergency dispatches (Spahn, 1995): “While it is commonplace to visualize the fire department communications section, or communications center, as part of the fire department, it is not always necessary to organize it that way. Without doubt, it is important that the local fire service agency maintain a strong control of how fire department affairs are administered by a communications center” (p. 522).

Cary’s ECC is one of three public safety answering points (PSAPs) in Wake County. The other PSAPs are Raleigh/Wake Emergency Communications Center and Holly Springs. Cary’s ECC answers 911 and non-emergency calls for Cary 24 hours a day/7 days a week. Emergency communications personnel are responsible for dispatching police, fire, emergency medical services, and animal control calls. The ECC is operated by the Town of Cary Police Department.

According to Chris Davis, Cary Police Department Support Services Manager, the Town of Cary Police Department has been accredited since 1992 by the Commission on Accreditation for Law Enforcement Agencies, also known as CALEA (personal interview, December 22, 2010). Davis says the Police Department, including the ECC, has been re-accredited five times since 1992 and is due for evaluation in 2012. According to Davis, during the last re-accreditation process in 2009, the department was awarded Flagship Agency status. The CALEA Flagship Agency Program is designed to acknowledge CALEA accredited public safety agencies that have demonstrated success in the accreditation process (CALEA, 2010).

The Fire Department is dependent on the Police Department's ECC to receive the call for service, process the call, and dispatch the Fire Department in a timely manner. As CFAI's *Fire & Emergency Service Self-Assessment Manual* 5th Edition (2006) explains, this is an essential component of the total response time matrix. To understand the complexity of response times, the CFAI manual states, it is important to define the individual components of the total response matrix. Historically, CFAI explains, the fire service community has interpreted this data in many different ways; for this reason, it is critical that common terminology consistent with CFAI definitions be used to evaluate the data for a "comparative analysis." This standardization, says CFAI, allows a true comparison that will provide reliability and validity of the data, not subjective interjection, to be used by department in the self-assessment process.

The CFAI manual defines the three individual components of the total response matrix as call processing time, turnout time, and travel time. Together, says CFAI, they make up the total response time. As the manual explains: "It is important to recognize that the individual time elements are critical components of an organization's ability to positively impact the outcome of an emergency event. Fire growth is exponentially based upon concentration of fuels, elapsed time to intervention, atmospheric conditions etc. Similarly, medical emergencies, especially in terminal events such as cardiac arrest, the elapsed time to effective intervention has a direct relationship in determining survivability and ultimately, quality of life" (p. 69).

Robert C. Barr, president of the fire protection consulting firm Firescope, and Anthony P. Caputo, president of the fire protection consulting firm Pyrotech Consultants, echo that sentiment: "Nothing is more important than the element of time when an emergency is reported. Fire growth can expand at a rate of many times its volume per minute. Time is a critical factor for the rescue of occupants and the application of extinguishing agent" (Barr & Caputo, 2003).

CFAI (2006) utilizes the Utstein Model and Criteria to demonstrate this concept by identifying the elements of emergency response and the importance of time with respect to intervention and corrective action (see Figure 1).

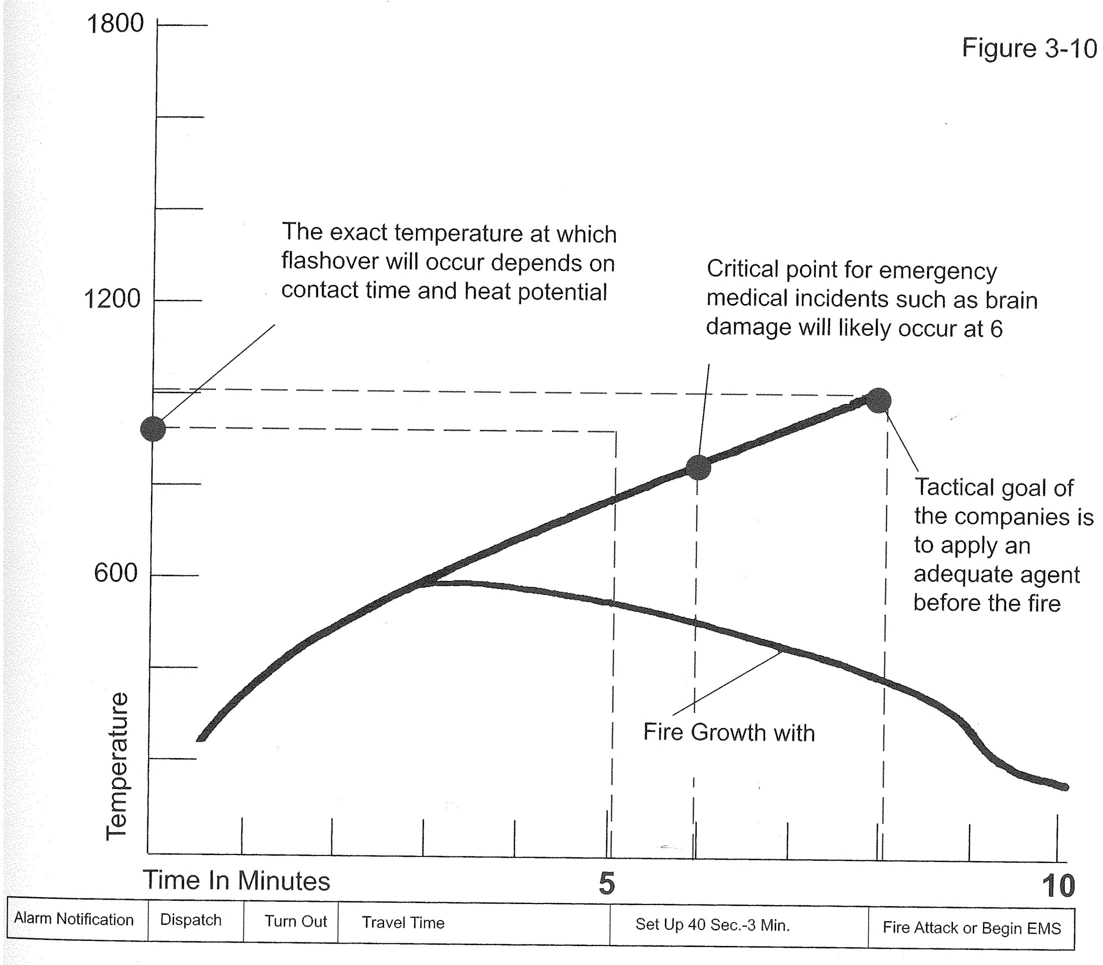

Figure 1. Depiction of the impact of time on the effectiveness of emergency response efforts. Reprinted from *Fire & Emergency Service Self-Assessment Manual* 7th edition, by the Commission on Fire Accreditation International, 2006, p. 69.

The impact of call processing on the Town of Cary Fire Department's total response time became very apparent in late 2009 and early 2010 as the department prepared its Standard of Response Coverage (SORC), one of the documents required for the 2010 CFAI re-accreditation process. The SORC work team was chaired by this author and included members of the Fire Department and of the Town's Technology Services Department, particularly its Geographic Information Systems (GIS) staff. Another observation made by the team was that call processing times from the ECC were being reported inconsistently; the majority of the time, the center was reporting average times and not the 90th percentile calculations needed to determine whether the department was meeting its stated response time standard. The main reason for the inconsistent reporting appeared to be a lack of communication between the ECC and the Fire Department. This was fixed by simply clarifying the data request, but it appeared to be the result of a larger issue.

Prior to the 2004 re-accreditation process, the Fire Department reported the times for the individual components of the total response time formula in averages. During the 2004 site visit, the CFAI peer review team informed the department that the criteria for standards of response coverage had evolved from a departmental policy to a standard that required approval from the local governing board and required reporting of fractal measurements and not averages. The response time goals should be based upon actual performance evaluation. The actual 90% call processing time for all calls for 2005 was 105 seconds; the average was 69 seconds. The department submitted a revised Standard of Response Coverage for approval by the Town Council at the January 2005 Council meeting. The department based its revised Standard of Coverage goals on CFAI's future benchmark recommendations in its *Fire & Emergency Service*

Self-Assessment Manual 7th ed. for an urban response area with little or no evaluation of the department's actual performance in regard to call processing and turnout times. The main emphasis was placed on total response time. The submitted document did clearly indicate a goal for call processing and dispatching of less than 60 seconds, but it did not clearly indicate the goal should be 90% as opposed to the average. The newly adopted response goal and expectation was communicated to the Police Department and the ECC as an afterthought and did not include their input on the preparation of the response goals or the feasibility of meeting the goals.

During the next five years, the department began to place more emphasis on the individual time components of total response time. However, the goal for call processing time was not communicated to the ECC in a formal document, actual performance was not evaluated, and, even though the call processing time goal was mentioned in the department's SORC, the overall emphasis was placed on total response time and not the individual components.

The primary goal of accreditation for the fire service is continuous improvement in all aspects of emergency service delivery (CFAI, 2006). In order to improve effectiveness and efficiency and to identify potential gaps and areas for improvement in the department's total response time, the department must first understand the ECC's current call processing times. The study will determine call processing time and allow a comparison with the accreditation benchmark for an urban area and other national consensus standards. The study is in line with the intended goal of the Executive Fire Officer program, which is to research an issue facing the fire service and apply the finding to effective and efficient solutions that can improve the fire service profession.

Literature Review

A multitude of professional organization standards, national consensus standards, and recommended performance criteria address communications center processes, facility equipment, center staffing, and call processing or call handling times. Many have similar but slightly different definitions for this process, which presents a challenge when evaluating data of this type. "The most chronic and unresolved problem in measuring performance is the difficulty of comparing apples to apples, sometimes described as definitional ambiguity," explains Bruce Moeller, the Sunrise, FL, fire chief and an International Association of Fire Chiefs Professional Development Committee member, in an August 1, 2005, *Fire Chief* article.

On a national level, the Association of Public-Safety Communications Officials (APCO) International and the National Emergency Numbers Association (NENA) are the two largest professional organizations in the field of telecommunications. According to APCO's website (http://apco.org/), "it is the world's oldest and largest professional organization dedicated to the enhancement of public safety communications." APCO, the site states, has 15,000 members worldwide and "creates a platform for setting professional standards, addressing professional issues and providing education, products and services for communications systems that are used by police, fire and emergency medical dispatch agencies throughout the world."

According to the "About NENA" section of its website (http://nena.org/about), NENA is a professional organization that serves the greater public safety community. It states that it has 7,000 members in 48 chapters around the world and is focused on 911 policy, technology, operations, and education issues. NENA has a stated goal of promoting the implementation and awareness of 911 as well as international three-digit emergency communications systems.

APCO and NENA worked together to develop voluntary consensus standards for the telecommunication industry to assist Public Safety Answering Point (PSAP) managers and their governing bodies in identifying current capabilities, APCO's "Public Safety Answering Point (PSAP) Service Capability Criteria Rating Scale" (2010) explains in its executive overview. However, neither APCO nor NENA has developed a standard on call processing times. NENA published a Call Answering Standard/Model Recommendation (2006), which includes a voluntary standard for answering 911 calls. It states, "Ninety percent (90%) of all 911 calls arriving at the Public Safety Answering Point (PSAP) shall be answered within ten (10) seconds during the busy hour….. Ninety-five [percent] (95%) of all 911 calls should be answered within twenty (20) seconds" (p. 8).

NENA, the Standard/Model Recommendation document states, developed the recommendation to provide uniformity and consistency in the handling of 911 and other emergency calls as well as administrative non-emergency calls, with additional guidelines for non-standard calls and recommended actions to address data failure, equipment problems, and redundant calls.

On a state level, the North Carolina 911 (NC 911) Board summarizes the legislative history of 911 service on its website (https://www.nc911.nc.gov/legislation/index.asp) as follows: "In 1989, the North Carolina General Assembly passed the Public Safety Telephone Act recognizing 911 as a toll free number through which an individual in the [s]tate can gain rapid, direct access to public safety aid. The Act became law as North Carolina General Statute Chapter 62A. Local governments were to set a rate and collect a 9-1-1 service fee to pay eligible costs associated with providing that direct access to Public Safety Answering Points (PSAP).

When wireless phones became popular, they did not fit the wireline model for providing location information, so in 1998 the Legislature adopted NC Senate Bill 1242 providing for a 911 Wireless Fund and creation of the Wireless 911 Board. This bill defined the composition of the fund and the requirements for participation. It became law as Article 2 of §62A. During the 2007 legislative session House Bill 1755 was introduced 'to modernize and improve the administration of the State's 9-1-1 system through a statewide 9-1-1 Board by ensuring that all voice services contribute to the 9-1-1 system and by providing parity in the quality of service and the level of 9-1-1 charges across voice communications service providers.' The bill was passed as Session Law 2007-383, and took effect January 1, 2008. It requires all voice communications service providers to collect a single rate 9-1-1 service fee and remit collections to the State 9-1-1 Board rather than to the local governments. The State 9-1-1 Board distributes funds to the PSAPs based upon criteria set forth in the new law."

According to the 911 Board website, North Carolina General Statutes defined a Public Safety Answering Point (PSAP) as "the public safety agency that receives incoming 911 calls and dispatches appropriate public safety agencies to respond to such calls," and it defined Eligible PSAPs as PSAPs "that have opted to provide wireless Enhanced 911 service and have submitted written notice to their commercial mobile radio carrier [CMRS] providers and to the Wireless 911 Board." According to the 911 Board's policy for PSAP eligibility (2006), among the criteria the PSAP must meet are:

- The PSAP has opted to provide Wireless Enhanced 911 service and is capable of receiving and processing incoming 911 calls from a Wireless Enhanced 911 system as that term is defined in NC General Statute 62B-1(15).

- The PSAP meets the qualifications for a primary PSAP under N.C.G.S. 62A-21 (11). It must both receive the initial incoming calls under a basic or an enhanced system and then dispatch the assistance requested. The city/county manager or designee must certify that both of these conditions exist.
- The PSAP equipment vendor or a commercial mobile radio services (CMRS) provider operating in the PSAP's jurisdiction must also certify that the PSAP is capable of receiving and dispatching Phase I wireless enhanced 911 service. If neither an equipment vendor nor a wireless carrier is available, a city or county may use certification from a technology specialist satisfactory to the Board to meet this requirement.

According to the 911 Board section of the NC 911 website, 911 Board members are appointed by the Governor, the President Pro Tem of the Senate, and the Speaker of the House. The 911 Board, the site explains, is made up of 17 members, 8 of which are local officials and include representatives from the League of Municipalities, the Association of County Commissioners, the Sheriff and Police Chief Association, the Association of Public Safety Communication Officials, and the National Emergency Number Association. Eight members are vendors in the communications field and include three members representing CMRS providers, four representing Local Exchange Carriers, and one representing a voice over internet protocol (VoIP) provider. The Chief Information Officer of Information Technology Services or his or her designee is the 17th member and the board chair.

The North Carolina State 911 Plan (2010) explains the plan's own history in the document's History section as follows: During the 2005 Session of the General Assembly, the

NC 911 Board was charged with developing a comprehensive enhanced wireless emergency telecommunications plan. In May 2009, the 911 Board created a 911 study group to develop a draft State 911 Plan. The individuals in the study group represented various disciplines of local government having responsibilities in the 911 field and came form both rural and urban areas across the state. This study group evaluated the condition of the state's 911 system and met 11 times. Study group representatives met twice with the full 911 board to present the group's findings and recommendations. The board accepted many but not all of the group's recommendations. The North Carolina State 911 Plan was submitted by the 911 Board to the Joint Legislative Commission on Governmental Operations, Revenue Laws Study Committee, and the Joint Legislative Utility Review Committee May 14, 2010.

The State 911 Plan included a prioritized list of 13 findings and recommendations with a detailed time line of implementation for each recommendation. A couple of the recommendations were directly related to call handling standards and data collection. Finding number two stated: "There are no established statewide operational standards in North Carolina for [PSAP]s" (p.11). Four recommendations addressed this finding, two of which included the establishment of minimum standards for PSAPs in the state. A 24-month time line was established for a subcommittee to develop standards. The plan recommends utilizing several sources, all of which will be referenced by this author, to create minimum PSAP standards for North Carolina.

Finding 11 in the State 911 Plan states: "For comparison and planning purposes, local governments and 911 directors could benefit from easy access to PSAP performance, statistical, and operational data provided by other primary PSAPs in the state. As minimum PSAP operational standards are implemented, a standardized reporting format and reporting interval should be established for collection of this data to ensure it is valid and verifiable, and it should be easily accessible from one centralized location such as the 911 Board website. 9-1-1 fund distributions to PSAPs could be dependent upon them self-reporting the validated data to encourage compliance. The development of standards as recommended in this plan will also require a mechanism in which these standards can be stored and from which they may be retrieved. Absent any new standards, there are significant amounts of information that currently exist that would benefit from a central repository (pp. 26-27)." Evaluation of this information would be extremely beneficial to understand how the performance of the Town of Cary's Emergency Communications Center compares with other centers in the state. The time line for this recommendation is June 2015. The Town of Cary ECC supervisor currently attends all the meetings of the 911 Board and maintains awareness of the recommendations presented by both the subcommittees and the board.

A study conducted by two members of the Worcester Polytechnic Institute Fire Protection Engineering Program, Robert Upson and Kathy Notarianni, titled "Quantitative Evaluation of Fire and EMS Mobilization Times" (2010), lists the four National Fire Protection Agency (NPFA) four standards related to operational benchmarks for alarm handling time: NFPA 450, *Emergency Medical Services and Systems;* NFPA 1221, *Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems;* NFPA 1710, *Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations and Special Operations to the Public by Career Fire Departments;* and NFPA 1720, *Volunteer Fire Department Deployment*. NFPA 450 and 1710 have limited information, the authors note, and both refer to NFPA 1221 for operational guidelines.

NFPA 1221, *Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems,* addresses the installation, performance, operations, and maintenance of public emergency services communications systems and facilities (NFPA, 2010).

The purpose of the standard is to: (a) specify operations, facilities, and communications systems; (b) provide requirements for the retransmission of such alarms to the appropriate emergencies response agencies; (c) provide requirements for dispatching of appropriate emergency response personnel; and (d) establish the required level of performance and quality of installations of emergency services communications centers (NFPA, 2010).

The standard clearly defines the call process in Chapter 3, Definitions, under Emergency Alarm Processing/Dispatching, as follows: “a process by which an alarm answered at the communications center is transmitted to emergency response facilities (ERFs) or to emergency response units (ERUs) in the field” (NFPA, 2010, p. 7). The standard states that “90% of emergency alarm processing shall be completed within 60 seconds, and 99% of alarm processing shall be completed within 90 seconds” (NFPA, 2010, p. 15). NFPA 1221 goes a step further and divides alarm handling time into three processes — alarm answering time, alarm processing time, and alarm transfer time —and lists specific performance requirements for each process, but the standard does not list specific definitions for these processes in Chapter 3, Definitions. Per the standard, the statistical analysis for this data should be conducted monthly, and the authority having jurisdiction (AHJ) has the authority to exclude calls that require extra interrogation time and to list examples of specific call types but allows the AHJ to identify and review the calls on a monthly basis (NFPA, 2010).

NFPA 1710, *Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations and Special Operations to the Public by Career Fire Departments,* lists specific definitions for alarm handling, alarm answering time, alarm processing time, and alarm transfer time in Chapter 3 and lists the same requirements in Chapter 4, as specified in the NFPA 1221 standard. This fact is listed on the first page in the Origins and Development section: "The requirement for time frames for alarm handling have been revised to correspond to changes being made to NFPA 1221" (NFPA, 2010, p.1).

The Commission on Fire Accreditation International (CFAI) also provides recommendations for call processing time for fire departments that are accredited or departments that seek to be accredited. Its mission, as stated in its *Fire & Emergency Service Self-Assessment Manual, is* "to assist the fire and emergency service agencies throughout the world in achieving excellence through self-assessment and accreditation in order to provide continuous quality improvement and enhancement of service delivery to their communities" (CFAI, 2006, p.7). The CFAI accreditation process requires an agency to complete three processes or documents in order to be considered for accreditation. The documents are the Fire & Emergency Services Self-Assessment Manual (FESSAM), the Standard of Response Coverage (SORC), and a Business Plan.

The cornerstone and critical element of the CFAI accreditation process is conducting the self-assessment of an organization against a set of criteria covering 10 major categories (CFAI, p. 75). There are 244 performance indicators for the 10 categories, which are essentially those activities that the CFAI has agreed upon as being appropriate in achieving the goals and objectives of a credible organization and that can be quantified within a reasonable time frame (CFAI, 2006, p. 31). An organization's criteria, which are supported by the performance indictors, are used by the peer assessors and CFAI to make credibility judgments regarding the organization. (CFAI, 2006, p. 31).

Baselines and benchmarks must be established in order to quantitatively measure an organization's performance, CFAI asserts (2006). A baseline is defined as a database from which something can be judged, and a benchmark is a standard from which something can be judged (CFAI, 2006, p. 31).

CFAI defines response time, for the accreditation process and as a method of consistent evaluation, as alarm processing time, turnout time, and travel time. The specific CFAI definition for alarm processing is "the time interval from the point at which a request or alarm is received and transmitted to emergency responders" (CFAI, 2006, p.71). The CFAI benchmark for alarm processing time is 60 seconds 90% of the time (CFAI, 2006).

The Cary Fire Department and the Cary Town Council adopted this performance objective for call processing time in 2005 as the department's benchmark based on the recommendation of the CFAI manual. Unfortunately, there was little or no evaluation of the Emergency Communications Center's call processing baseline performance data to determine if this performance measure benchmark was achievable. However, this lack of data or evaluation is consistent with Upson and Notarianni's "Quantitative Evaluation of Fire and EMS Mobilization Times" (2010). The study found that "comprehensive data on fire emergency and

EMS call processing and turnout time is largely absent from the published literature" (Upson & Notarianni, p. 1).

The study provides a quantitative evaluation of fire emergency and EMS mobilization times and identifies key factors that affected their performance (Upson & Notarianni, p. i). A group of large fire service organizations across North America provided actual recorded alarm handling times for the study; the times were complied for the statistical analysis and then compared with the target alarm handling times given in NFPA 1221. The results demonstrated that for both fire and EMS calls, the mean average alarm handling times observed fell well within the current 60 second benchmark. For approximately 80% of the fire and EMS calls, alarm handling was completed in the required 60 seconds or less, as compared with the 90% target listed in the standard. The actual time required for alarm handling at the 90% benchmark was 92 seconds for fire and 84 seconds for EMS, and the combined fire and EMS alarm handling was 90 seconds at the 90th percentile (p. 36). While the NFPA standard does not distinguish alarm handling time between fire and EMS, the study elected to provide both separate and combined alarm handling times because of the potential differences in the nature of information, the amount of information, and the level of detail needed to process (Upson & Notarianni).

The Cary Police Department, which manages the Emergency Communications Center, is accreditated by the Commission on Accreditation for Law Enforcement Agencies, (CALEA). CALEA was created in 1979 as a credentialing authority through the joint efforts of law enforcement's major executive associations (CALEA, 2010). According to the "Accreditation" section of the CALEA website (http://www.calea.org/content/accreditation), "the purpose of CALEA's Accreditation Programs is to improve the delivery of public safety services, primarily by: maintaining a body of standards, developed by public safety practitioners, covering a wide range of up-to-date public safety initiatives; establishing and administering an accreditation process; and recognizing professional excellence."   Just like accreditation for the fire service, CALEA examines all aspects of the police department, including the communications center, if applicable to the organization.

According to Chris Davis, the Police Support Services Manager, the communications center is addressed in Chapter 81, Auxiliary and Technical Services. The three areas evaluated in Chapter 81 are Administration, Operations, and Facilities and Equipment. CALEA does not mandate exactly how calls are to be processed or establish performance requirements or recommendations but does require certain standards, such as how information should be recorded and communications between the center and field personnel.   Fourteen substandards under the Operations section apply to call taking.

Another agency that evaluates communications centers is the Insurance Services Office (ISO). According to the "About ISO" section of the ISO Mitigation website, "ISO evaluates municipal and rural fire-protection efforts in communities throughout the United States for property/casualty insurance risk" (http://www.isomitigation.com/docs/about0001.html). ISO's "Publication Protection Classification Summary Report," prepared for the Cary Fire Department (2010), explains how ISO conducts this evaluation using the Fire Suppression Rating Schedule (FSRS), which measures the major elements of a community's fire-suppression system and develops a numerical grading called a Public Protection Classification (PPC). Insurance companies use PPC information to help establish premiums for fire insurance, ISO explains in the report: The better a community's PPC rating, the lower homeowners' and commercial owners' insurance premiums. This methodology is utilized, the report says, because it has been proven that a community's investment in fire mitigation is a reliable predictor of future fire losses.

The report breaks down the evaluation process further. It outlines the three areas of a community ISO evaluates: receiving and handling of fire alarms, water supply, and fire department. Receiving and handling of fire alarms accounts for 10 percent of the total rating, the report states, and involves evaluation of communications staff and equipment. Specifically, the report says, ISO compares the number of telephone lines provided with the number of telephone lines needed for emergency and business calls and compares the number of fire alarm operators provided with the number of operators needed. According to ISO, the number of needed operators depends on whether the community is meeting its performance standards with existing operators for receiving and dispatching alarms. If performance data is unavailable, the number of needed operators is based on the number of alarms received, alarm dispatch circuits, and the type and arrangement of the communications facilities. ISO does not recommend call processing performance criteria for the communications center.

The Emergency Communications Center received 7.10 points out of a possible 10 points during the evaluation of the Cary Fire Department in February 2010 (ISO, 2010). According to Terry Yates, who is the telecommunications manager for the Town of Cary, the ECC is well equipped with the latest technology and is commensurate with centers serving jurisdictions of similar size and demographics and meets the North Carolina General Statute for PSAPs in North Carolina.

The main technological components of Cary's ECC include Enhanced 911, which provides Automatic Number Identification/Automatic Location Identification (ANI/ALI), the phone system, which is Customer Premise Equipment. AT&T provides the service and maintenance; Computer Aided Dispatch – HTE/SunGard, Emergency Medical Dispatch (EMD), Special Needs Assistance Programs (SNAP), and a Telecommunications Device for the Deaf (TDD).

The ECC utilizes a Motorola Gold Elite System that is connected to the UHF 800 MHz trunked radio system, which allows communication and notification to emergency personnel in the Town and has additional connections to various county and statewide radio systems. Specifically, the fire stations are notified of alarms via the 800 MHz radio system and a station buzzer system. Maintenance for this system is provided by Motorola and Wireless Communications. The ECC maintains a Variant Audiolog Recorder accessible from all 911 positions. This system records all radio, 911, and administrative phone traffic. Maintenance for this system is provided by Carolina Recording Systems.

The center has been Phase I and Phase II compliant since 2004. Phase I refers to the wireless carriers sending the address of the tower site that the wireless caller is calling from, along with the caller's phone number, to the PSAP. Phase II refers to the wireless carrier sending the actual latitude and longitude coordinates of the wireless caller's location, along with the caller's phone number, to the PSAP. Those coordinates are then mapped to Looking Glass Mapping Software. This software enables wireless 911 calls, as well as wireline 911 calls, to be automatically plotted on a map. This speeds 911 call processing and eliminates mistakes made by manually entering a caller's location coordinates and then entering the nearest address into the

CAD system. Cary’s Emergency Communications Center and Raleigh/Wake 911 Communication have selective routing and selective transfer, allowing a PSAP the ability to transfer a 911 call to another PSAP with the push of one button.

According to Doug Workman, the Cary ECC supervisor, the ECC has 24 employees which include 1 ECC Supervisor, 5 Shift Supervisors, 17 Emergency Communications Officers (ECOs), and 1 CAD Specialist. Minimum staffing levels are two ECOs, with a goal of three on duty at all times. This meets NFPA 1221, Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems, which requires that at least two telecommunicators be on duty at all times and at least one supervisor to be on duty when more than two telecommunicators are on duty (2009). At full staffing, the center has three ECOs and a supervisor on each shift and up to four ECOs during peak call times. All ECOs are required to be on call on a rotating basis in order to ensure the ability of the ECC to maintain minimum staffing levels and to be prepared for unforeseen emergencies that could overwhelm normal staffing.

The ECC follows APCO and NENA guidelines for facility equipment/technology and operational processes to ensure uniformity and consistency in the handling of 911 calls and meets the North Carolina 911 Board policy for PSAP eligibility. The Town’s Telecommunications Manager, Terry Yates, verifies that the ECC is well equipped and meets the industry standards for PSAPs. The Police Department and ECC staff also follows the NC 911 Board’s work on the draft North Carolina 911 Board Operating Standards, which will cover the installation, performance, operation, and maintenance of public emergency services communications systems and facilities.

Procedure

The first research question, to what extent do call processing times exceed applicable standards and the approved goal, was evaluated by conducting a search of applicable national consensus standards, professional organizations standards, recommended performance criteria that address communications center processes, facility equipment, center staffing, and call processing or call handling times. This literature review began with a word search for "Public Safety Answering Point (PSAP)" followed by "call processing and alarm handling" at the National Fire Academy's Learning Resource Center and on the Internet. For the literature review, the NFPA definition for alarm handling time was utilized. All the information and sources were gathered and researched. A questionnaire was utilized to evaluate the ECOs' familiarization with current standards and response time goals. The questions related to current standards, and response time goals were added to measure a potential educational gap identified during the research of this project.

The call processing/alarm handling time data for the Fire Department's 2010 re-accreditation process was utilized for this review. This process requires review of data for at least three years prior to the re-accreditation site visit; therefore, 2005 through 2009 data is represented. The Town of Cary's Technology Services Department assisted the Fire Department by developing and performing analyses of the data required for accreditation. Technology Services staff utilized SAS Institute's SAS Enterprise Guide to compile data from disparate sources to provide a cohesive analysis. The data sources included fire incident event times from SunGard's HTE Fires software, which produced event times (Dispatch, Enroute, At Scene, and

Available) for all units on all calls; fire incident information from HTE Fires, which produced information related to all calls, such as alarm times, emergency status, and actual first-in apparatus; HTE CAD information, which mapped fire incident records to the originating CAD call information, enabling determination of the assigned map reference number of the call; and map references from MapInfo Geographic Information System (GIS), which allowed data points to be plotted and assigned a current fire district assignment and a future fire management zone to each call, based on the call's map reference number. Units were placed into an Excel lookup table. This table was used to assign information specific to this analysis regarding units — for example, which units are first due and how the units are classified (Aerial, Truck, Command, Engine, Rescue). National Fire Incident Reporting System codes (NFIRS) were also placed into an Excel lookup table. This table was utilized to classify calls according to the call type (e.g., structure fires, rescues, hazardous materials).

Utilizing SAS Enterprise Guide's query capabilities, Technology Services staff compiled the various data sources to create a cohesive view of each call to which the Fire Department responds. The results produced a table (ALL_FIRE_CALLS) that contained a record for each apparatus on each call. With the exception of removal of errant data, no filtering was conducted at this stage of the analysis. The data contained the following information:

- call identifiers
- location information (e.g., street address, map reference number, current fire district, fire strict at time of call, fire management zone)
- apparatus identifying information (e.g., designator, apparatus type, station assignment)

- response status (e.g., emergent or non-emergent)
- call first-due apparatus
- call actual first-in apparatus
- category of call
- even times for apparatus (“alarm” time, “dispatch” time, “en-route” time, “at-scene” time, and “cleared” time)

Using the master dataset created above, calls in which mutual aid was given by the Town of Cary were removed. This analysis was performed on both emergent and non-emergent calls.

Using the “first-due” and “first-in” indicators, reliability percentages were determined. Using an acceptable performance indicator of less than 5 minutes travel for the “first-in” unit, staff was able to determine performance rates for calls when the actual “first-in” unit was the expected “first-due” unit. Likewise, staff was able to calculate performance when actual “first-in” was not the “first-due.” Also, staff was able to export a list of calls with addresses that failed to meet performance criteria. Theses calls were plotted for spatial analysis. All data was exported to Excel for use by the Fire Department staff.

All other analyses were performed on calls that were designated as having an emergent response. Again, calls in which mutual aid was given to a neighboring municipality were removed. The following apparatus times were calculated:

- apparatus travel time: the interval between “en-route” and “at-scene.”
- apparatus turnout time: the interval between “dispatch” and “en-route.”
- apparatus total response time: the interval between “alarm” and “at-scene.”

- apparatus unavailable time: the interval between “dispatch” and “cleared.”

The following call statistics were calculated:

- call processing time: the interval between “alarm” and “dispatch.”
- 1st turnout: the interval between a call’s earliest “dispatch” time to the call’s earliest “en-route” time.
- 1st on scene travel: the interval between “en-route” and “at-scene” for the first unit to arrive on the scene.
- 1st on scene total response: the interval between “alarm and “at-scene” for the first unit to arrive on scene.
- ERF (emergency response force) travel: for the purpose of this analysis, ERF was defined as the list of apparatus on a call that were dispatched within 20 seconds of the first “dispatch” time of the call. The travel time is the interval between the “en-route” time of the first ERF apparatus to be “en-route” and the “at-scene” time for the last ERF apparatus to arrive on the scene.
- ERF total response: the interval between the call’s “alarm” time and the “at-scene” time for the last ERF unit to arrive on the scene.
- call unavailable time: the interval between the earliest “dispatch” time until the latest “cleared” time on a call.
- engine earliest travel: the apparatus travel time of the first engine to arrive on the scene.
- engine earliest total response: the apparatus total response of the first engine to arrive on the scene.

- earliest travel and earliest total tesponse were also calculated for aerials, rescues, trucks, and command (battalion chiefs) similarly to the engine calculations above.

Once the call statistics were calculated, the calls were grouped according to criteria specified by the Fire Department (eg., fire, EMS, rescue). Statistics (e.g., count, mean, and 90th percentile) were calculated across the group and reported by the SAS software system. Analyses were exported to Excel and provided to the Fire Department staff for inclusion in the accreditation report.

The second, third, and fourth research questions were evaluated using a questionnaire. The questionnaire contained 25 questions and was designed to elicit feedback from the Town of Cary Communications Center ECOs in the following three areas: (a) to what extent current processes contribute to extending call processing times, (b) to what extent current technology contributes to extending call processing times, and (c) to what extent behavioral factors contribute to extending call processing times.

Results

The Emergency Communications Center's goal is that all emergency calls will be processed, codified, and dispatched in a timely manner, ensuring the appropriate deployment of necessary resources and personnel to any emergency incident according to Mr. Workman.

The Cary Fire Department's benchmark for all call processing is 60 seconds 90% of the time for all calls, regardless of type.

The CFAI provides recommendations for call processing time for fire departments that are accredited or departments that seek to be accredited. The CFAI benchmark for alarm processing time is 60 seconds 90% of the time. This benchmark is based on NFPA standards and best practices of the fire service profession. The Cary Fire Department and Cary Town Council adopted this performance objective for call processing time in 2005 as the department's benchmark based on the recommendation of the CFAI manual.

NFPA 1221 recommends that 90% of emergency alarm processing be completed within 60 seconds, and 99% of alarm processing be completed within 90 seconds.

For all Fire Department emergency call types, the call processing for 2005, 2006, 2007, 2008, and 2009 were, respectively: 1 minute, 43 seconds; 1 minute, 34 seconds; 1 minute, 18 seconds; 1 minute, 28 seconds; and 1 minute, 22 seconds. The call processing mean time and call processing P90, or 90th percentile, are presented in seconds in Figure 2.

Call Year	Number of Calls	Call Processing Mean	Call Processing P90
2005	2886	67.54954955	103
2006	4585	52.12300981	94
2007	5161	42.94187173	78
2008	5202	47.96366782	88
2009	5201	50.93347433	82

Figure 2. Call processing mean and 90% times for all calls (in seconds).

Actual performance measurement at the 90th percentile for call processing for individual call classes are listed in Figures 3 through 6. The call types were determined by using the National Fire Incident Reporting System (NFIRS) disposition code, which is entered into HTE Fires by the first-arriving company officer. Structure fire calls included NFIRS codes of 111 through 118 and 120 through 123. EMS calls included NFIRS codes of 300, 311, and 321 through 324. Rescue calls included NFIRS codes 331, 340 through 343, 350 through 357, 360 through 365, 370 through 372, and 381. Hazardous material calls included NFIRS codes 400, 410 through 413, 420 through 424, 430, 431, 440 through 445, 460 through 463, 471, 480, and

481. The results will be discussed in greater detail in the discussion section of this research paper.

Call Year	Major Category	Num Calls	Call Processing Mean	Call Processing P90
2005	FIRE	183	54.60655738	100
2006	FIRE	225	44.77777778	79
2007	FIRE	262	43.52290076	82
2008	FIRE	236	48.37711864	89
2009	FIRE	199	49.25125628	86

Figure 3. Call processing mean and 90% times for structure fire calls (in seconds).

Call Year	Major Category	Num Calls	Call Processing Mean	Call Processing P90
2005	EMS	2160	71.68287037	105
2006	EMS	2663	52.92114157	100
2007	EMS	3139	39.56737815	73
2008	EMS	3314	42.63880507	82
2009	EMS	3453	47.48392702	67

Figure 4. Call processing mean and 90% times for EMS calls (in seconds).

Call Year	Major Category	Num Calls	Call Processing Mean	Call Processing P90
2005	RESCUE	87	62.56321839	93
2006	RESCUE	89	52.69662921	86
2007	RESCUE	98	46.71428571	87
2008	RESCUE	76	63.13157895	127
2009	RESCUE	76	62.36842105	109

Figure 5. Call processing mean and 90% times for rescue calls (in seconds).

Call Year	Major Category	Num Calls	Call Processing Mean	Call Processing P90
2005	HAZMAT	57	55.12280702	93
2006	HAZMAT	77	53.06493506	94
2007	HAZMAT	92	57.02173913	101
2008	HAZMAT	82	67.56097561	103
2009	HAZMAT	73	66.46575342	115

Figure 6. Call processing mean and 90% times for hazardous material calls (in seconds).

A questionnaire regarding call processing was sent to 21 ECOs, 1 CAD Specialist and 1 ECO supervisor. The ECO has 24 approved full-time equivalents, but one vacancy existed at the time of the survey. The questionnaire was divided into two 10-question surveys and one 5-question survey. Fifteen surveys, or 65%, were completed for section 1, and 14 surveys, or 60%, were completed for sections 2 and 3.

The results of the questionnaire indicate a possible lack of knowledge on the ECOs' part involving call processing performance, performance goals, and national consensus standards. Forty percent of the ECOs reported that they are not familiar with their personal call processing performance, and only 33.3% stated that they are somewhat familiar with the ECC's overall call processing performance.

Only 46.6% of the ECOs responded that they are somewhat familiar with the Cary Fire Department's goal or adopted Standard of Coverage for call processing times, and 46.7% said they are not familiar at all with the current NFPA standard related to call processing.

This lack of knowledge and awareness about call processing times may be caused by a lack of communication between the Fire Department and the employees' supervisors. The responses appear to be very random both when the ECOs were questioned about how often the

Fire Department communicated the importance of call processing time and how frequently the supervisors discuss call processing times.

While there does appear to lack of knowledge or understanding about standards and performance goals, 35.7% of the ECOs reported that they believe the NFPA-recommended call processing time of 60 seconds 90% of the time is reasonable.

When asked their recommendation for call processing time goal for the Fire Department, 64.3% of the ECOs who responded to the survey recommended 60 seconds 90% of the time, and more than 71% stated that call processing time is very important in relationship to the total response.

Specific questions were asked about the ECC’s current console configuration, CAD software, GIS software, and phone system. Sixty percent of the ECOs stated that they believe the current procedures have no effect on call processing times.

The majority of ECOs responded that they believe the individual technology components have no effect on call processing times, and approximately half (46.6 percent) stated they believe the current overall technology utilized by the ECC has no effect on their call processing time; however, 20% said they thought the current technology increases call processing times, and none of the ECOs said they thought technology decreases times.

The ECOs were asked about data transfer methods, wireline calls, and wireless calls, and 35.7 percent of the respondents reported believing that the current method of data transfer methods had no effect, but the same percentage reported that they believe the methods increase times.

The responses definitely suggest a difference between call processing for a wireline call and a wireless call. More than three-quarters of the respondents responded that they think wireless calls either have no effect or decrease call processing times, but 42% of the respondents responded that they believe wireless calls increase call processing times.

The ECOs were also questioned about motivation and capacity for improvement, and 64.3 % reported being highly motivated by personal satisfaction, while 57 % reported being highly motivated by the potential outcome of an emergency.

Being rewarded or recognized has no effect on call processing times, according to 71.4 % of the ECOs surveyed.

Fifty percent of the respondents indicated that public perception does not motivate their call processing time performance.

When questioned about whether they have reached their full potential in call processing ability, 7.1% responded that they thought no improvement was possible; 35.7% said they thought some improvement was possible, and 21.4% said they thought a lot of improvement was possible.

The final two questions included in the questionnaire examined the ECOs' perception of whether time of day and call type affected their call processing. In response, 78.6% of the ECOs said that the time of day affected their call processing time in some manner. The actual data indicates a lower call processing time for sleep/nighttime call processing for the years 2005 through 2009. The difference is 25% for 2007, 31% for 2008, and 28% for 2009. Sleep time as defined by the Cary Fire Department is the time between 11:30 pm and 7:00 am. Typically almost 25% of the department's calls occur during the hours between 11:30 pm and 7 am

In the survey, 92.9% of the ECOs indicated that they believe call processing time is affected by the type of call. This is verified by the actual data. The call processing time for all calls was 82 seconds, 90th percentile, for 2009. Comparing the four major call types examined during the study, there is a 4% increase in call processing times for fire-related events as compared to all calls, a 24% increase for rescue-related events, and a 28% increase for hazardous material emergencies, but EMS calls were processed 18% faster than the all call types together.

Discussion

The purpose of the research project was to conduct an analysis of the current call processing time performance to identify areas for improvements. The research questions were: (a) to what extent do call processing times exceed applicable standards and the approved goal, (b) to what extent do the current processes contribute to extending call processing times, (c) to what extent does current technology contribute to extending call processing times, (d) to what extent do behavioral factors contribute to extending call processing times, and (e) how can call processing times be improved.

Research was conducted for all applicable standards as they relate to call processing times. This was completed by conducting a search of applicable national consensus standards, professional organization standards, and recommended performance criteria that address communications center processes, facility equipment, center staffing, and call processing or call handling times. A questionnaire was utilized to evaluate the ECOs’ familiarization with current standards and response time goals. The questions related to current standards, and response time goals were added to measure a potential educational gap identified during the research of this project.

The call processing/alarm handle time data for the Fire Department's 2010 re-accreditation process was utilized for this review. The Town of Cary's Technology Services Department assisted the Fire Department by developing and performing analyses of the data required for accreditation. Technical staff utilized SAS Enterprise Guide to compile data from disparate sources to provide a cohesive analysis. The data sources included fire incident event times from HTE Fires, which produced event times (Dispatch, Enroute, At Scene, and Available) for all units on all calls.

One of the primary findings is that the Town of Cary Emergency Communications Center is not meeting national consensus standards and exceeds the CFAI recommendation and department-approved goal by 22 seconds for call processing of all calls. The goal is 60 seconds 90% of the time for call processing; however, the data is similar to Upson and Notarianni's findings in their "Quantitative Evaluation of Fire and EMS Mobilization Times" final report (2010). Upson and Notarianni state in the final report that alarm handling time and turnout time are specific measurable segments of emergency response time and that this type of comprehensive data is largely absent from published literature. The authors note: "To a large extent these benchmark times are based on qualitative data, experience, and assumptions and do not have strong body of empirical data to justify them. Preliminary data shows that these times may be unrealistically short in today's fire service environment and may lead to errors in analyses used to determine future fire station locations and determine mobile resource allocations; discourage fire departments from trying to meet performance objectives in these NFPA standards; and encourage unsafe practices in an effort to meet unrealistic alarm handling times and turnout objectives." (Upson and Notarianni, pp. 3-4)

The actual recorded alarm times were compiled utilizing SAS Enterprise Guide; evaluated; and compared with national consensus standards, professional organization standards, recommended performance, and the approved goal. The call processing mean average time for all calls, fire, and EMS fell well within the current 60 second benchmark for the five-year period except for 2005. The total call processing times was 67 seconds, and the EMS call processing time was 71 seconds. The call processing mean average time for rescue and hazardous material emergencies were slightly below or slightly above the 60 second benchmark for each of the five years.

The time required for alarm handling 90 % of the time for all calls was 82 seconds for 2009 and varied from 103 to 78 seconds for the five-year period. In 2009, it was 67 seconds for EMS and 86 seconds for fire. The times do exceed the performance goal establish by the Town and the NFPA and CFAI standards.

The findings are very similar to the final report produced by Upson and Notarianni, which found that for both fire and EMS calls, the mean average times, fell well within the current 60 second benchmark, while the time required for alarm handling 90% of the calls was 92 seconds for fire and 84 seconds for EMS.

Based on the questionnaire, it appears the Fire Department to could a better job of educating the ECC staff about the national consensus standards, CFAI recommendation, and performance expectations for the center in regard to call processing. Consideration should be given to the staff to receive their input and feedback on call processing times and goals in the future.

The remaining questions served to provide input and feedback on current processes, current technology, and behavioral factors and how each contributes to extending call processing times. The final question of how call processing times can be improved will be addressed in the recommendation section.

The ECC follows APCO and NENA guidelines as closely as possible for facility equipment/technology and operational processes to ensure uniformity and consistency in the handling of 911 calls. (Workman, 2010) The majority of ECOs believe the processes serve them well and have no effect on extending call processing times, but this satisfaction with the status quo could negate the desire to consistently monitor and adjust procedures, as needed, to meet national recommendations, as well as the NC 911 Board's work on the state plan to improve organizational performance.

Of those surveyed, 46.6% of ECOs stated that they think the overall technology utilized by the ECC has no effect on the ability to process calls. The ECC received a total of 7.10 points out of a possible 10 points during the ISO evaluation of the Cary Fire Department in February 2010. According to the Telecommunications Manager and the ECC supervisor, the ECC's hardware and software are evaluated on a yearly basis, and the Town is in the process of a CAD upgrade and the development of a request for a new radio system (personal interviews, November 10, 2010, and February 28, 2011). Work teams for both projects have been formed with a broad representation from all stakeholders with the goal to ensure the new systems will meet the needs of the organization.

The responses to the survey questions about data transfer methods and wireless calls create areas of concern, but with that concern come opportunities for improvement. The ECOs were asked about data transfer methods, wireline calls, and wireless calls. Of those who responded, 35.7% stated that they believe the current method of data transfer methods had no effect, but the same percentage said they believe the methods increase times. The responses definitely suggest a difference between call processing for a wireline call and a wireless call. More than three-quarters of the respondents stated that they think wireless calls either have no effect or decrease call processing times, but 42% of the respondents said they believe wireless calls increase call processing times. Additional research and data collection will be needed to quantify potential differences and exact causes.

Behavioral factors were also considered. These include personal satisfaction, rewards or recognition, time of day, type of call, and capacity for improvement. Of those who responded, 64.3 % stated that they are highly motivated by personal satisfaction, and 57 % said they are highly motivated by the potential outcome of an emergency. According to 71.4% of the ECOs, being rewarded or recognized has no effect on their call processing times, and 50% indicated that public perception has no effect on their call processing time.

What did prove to be interesting is the fact that 78.6% of the ECOs thought the time of day affected their call processing time in some manner. The actual data indicates a lower call processing time for sleep/night time call processing for all the years evaluated. Type of call also affects call processing time, according to 92.9% of the respondents. This is verified by the actual data. The call processing time in 2009 for all calls was 82 seconds 90% of the time. Breaking down the four major call types examined during the study, there is a 4% increase in call processing times for fire-related events compared to call processing times for all calls, a 24% increase for rescue-related events, and a 28% increase in call processing times for hazardous material emergencies, but EMS calls were processed 18% faster than all the call types together. Additional research will need to be conducted to ascertain potential causes.

When questioned about their ability to improve their call processing skills, 7.1% said they thought no improvement was possible; 35.7% said they thought some improvement was possible, and 21.4% said they thought a lot of improvement was possible.

Recommendations

The purpose of this research was to conduct an analysis of the current call processing time performance to identify areas for improvement. The research confirmed that the Town of Cary Emergency Communications Center current call processing times exceed applicable standards, recommendations by the Commission on Fire Accreditation International, and the 60 second call processing goal as adopted by the Cary Town Council. This results in a longer total response time for emergency incidents. The following recommendations are a direct result of the data and research information compiled during this project.

First, the Fire Department administrative staff should meet with administrative communications center and Police Department staff to evaluate the communications center data and specific Fire Department standards related to call processing, including the CFAI recommendations for call processing time for accredited fire departments. Part of this process will be error/omission and fact checking. Once the information is verified and validated by all stakeholders, an open and frank discussion will need to occur between all stakeholders, including ECOs, to evaluate all applicable standards, actual call processing performance, other industry studies related to call processing, and the Fire Department expectation. A new standard of coverage can then be written that establishes a new benchmark for call processing that considers all applicable standards and expectations and is a true evaluation of actual capability-based objective baseline data with input from all departments and personnel involved.

Second, the Fire Department should develop a service level agreement with the ECC. This agreement should outline the type and level of service, along with standardized procedures for recording benchmarks for service, such as call processing time and the criteria for initiating, dispatching, and closing calls/alarms. This will formalize the Fire Department's expectations and performance objectives for call processing. This agreement will need to be evaluated at least annually and revised as needed.

Third, the Fire Department should add an employee from the ECC and from Technology Services to the accreditation work team. This work team should evaluate the data monthly and provide training and feedback to the ECC and Fire Department staff monthly, quarterly, and annually about call processing times. The work team should also be utilized to provide training for staff on changes to national consensus standards, state 911 Board guidelines, and CFAI recommendations for call processing. This will enable both departments to maintain dialogue about and awareness of changes that affect both professions.

Fourth, the affected departments should implement additional evaluation of the current data transfer methods both internal to the ECC and external to other PSAPs as well as call processing times for wireline and wireless calls to quantify the concerns expressed by the ECOs in the responses to the questionnaire used for this study.

Fifth, the Chief of Logistics, who is the Fire Department liaison to the ECC, should become more involved with understanding the telecommunications standards, the North Carolina 911 Board, and impacts of both on the Fire Department.

Additional research and evaluation will be needed by the Cary Fire Department and the fire service profession to quantitatively evaluate response times and to realistically match industry standards with actual performance.

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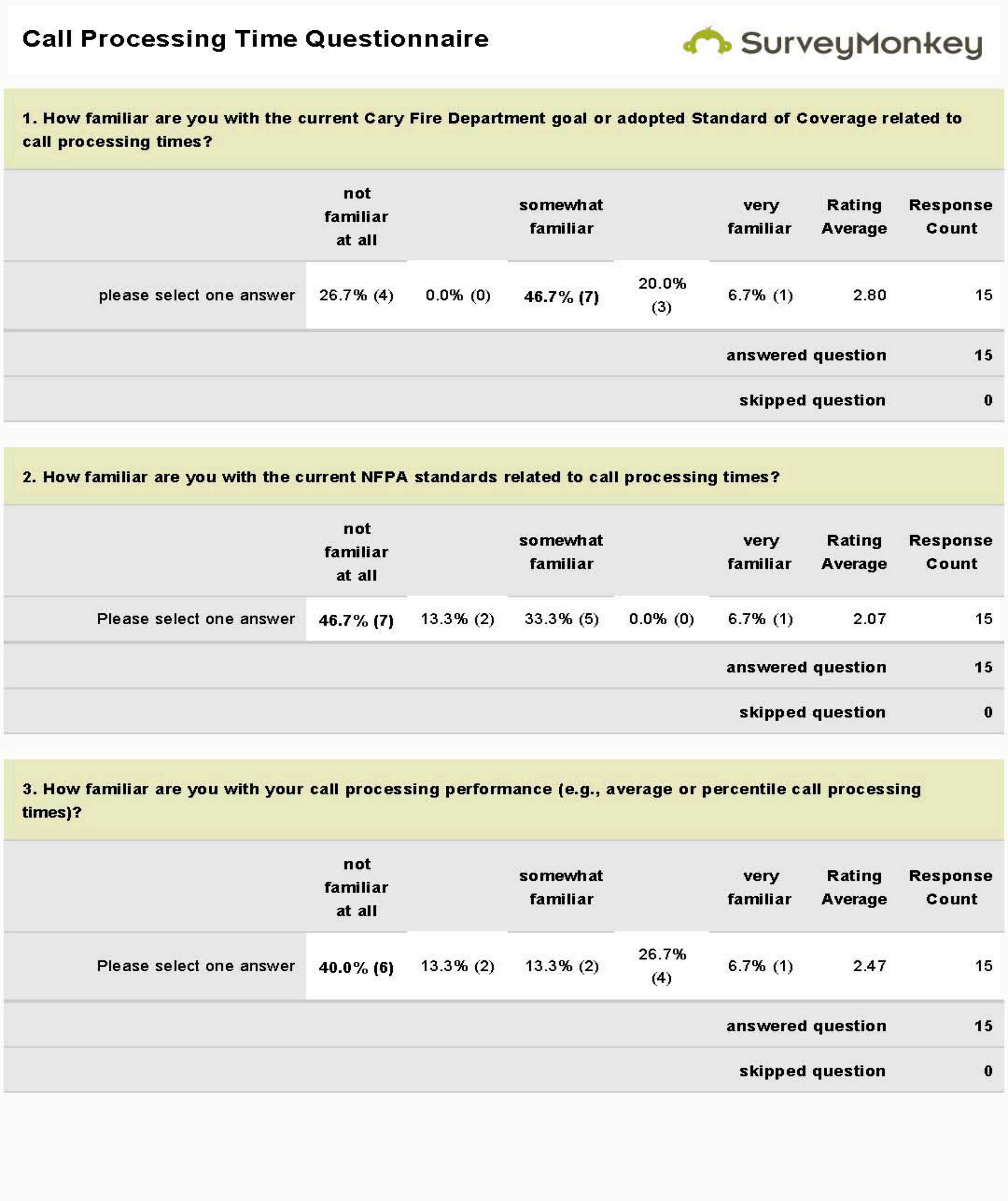
Appendices



Call Processing Time Questionnaire

1. How familiar are you with the current Cary Fire Department goal or adopted Standard of Coverage related to call processing times?

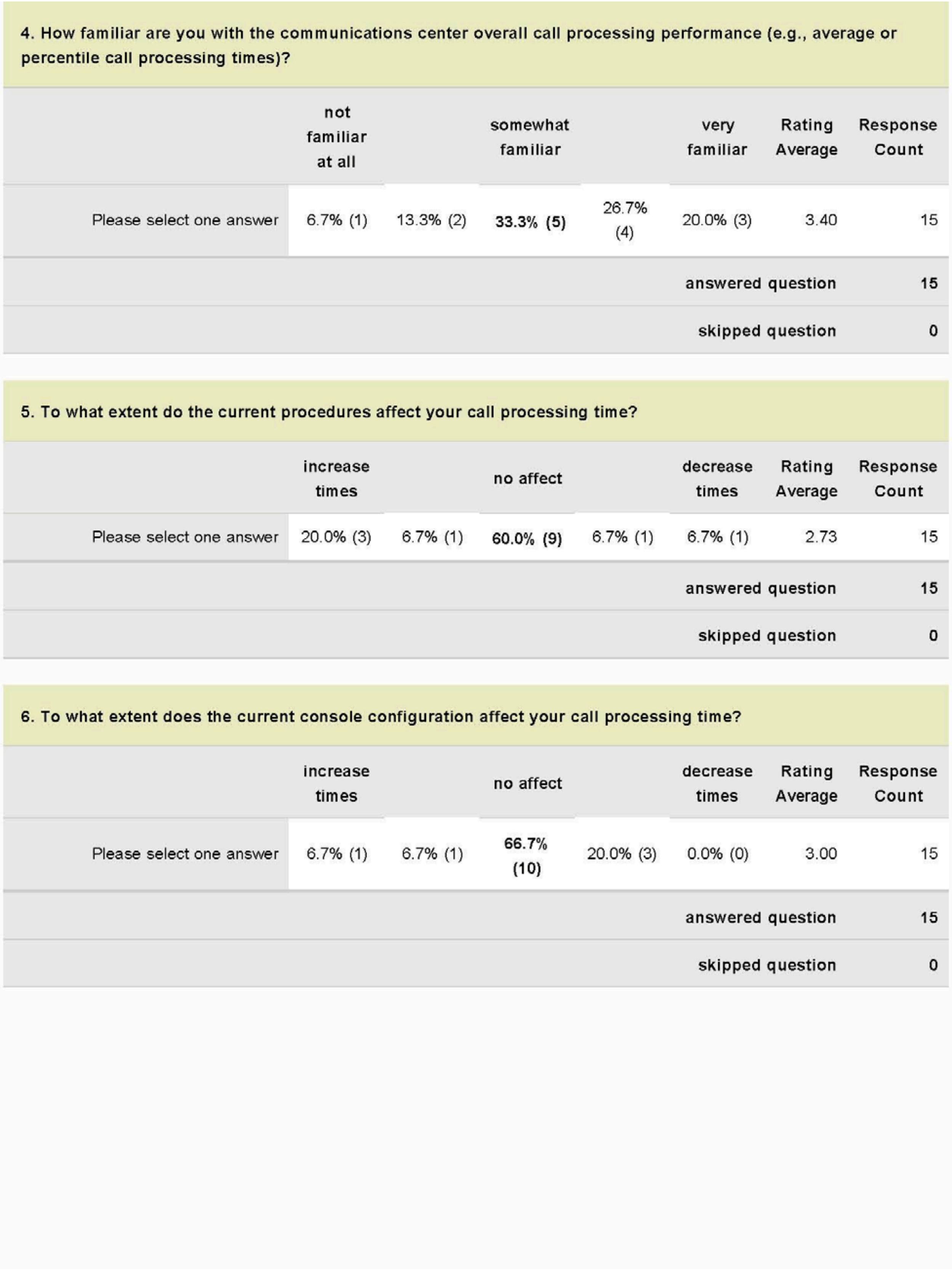
	not familiar at all		somewhat familiar		very familiar	Rating Average	Response Count
please select one answer	26.7% (4)	0.0% (0)	**46.7% (7)**	20.0% (3)	6.7% (1)	2.80	15
						answered question	**15**
						skipped question	**0**

2. How familiar are you with the current NFPA standards related to call processing times?

	not familiar at all		somewhat familiar		very familiar	Rating Average	Response Count
Please select one answer	**46.7% (7)**	13.3% (2)	33.3% (5)	0.0% (0)	6.7% (1)	2.07	15
						answered question	**15**
						skipped question	**0**

3. How familiar are you with your call processing performance (e.g., average or percentile call processing times)?

	not familiar at all		somewhat familiar		very familiar	Rating Average	Response Count
Please select one answer	**40.0% (6)**	13.3% (2)	13.3% (2)	26.7% (4)	6.7% (1)	2.47	15
						answered question	**15**
						skipped question	**0**



4. How familiar are you with the communications center overall call processing performance (e.g., average or percentile call processing times)?

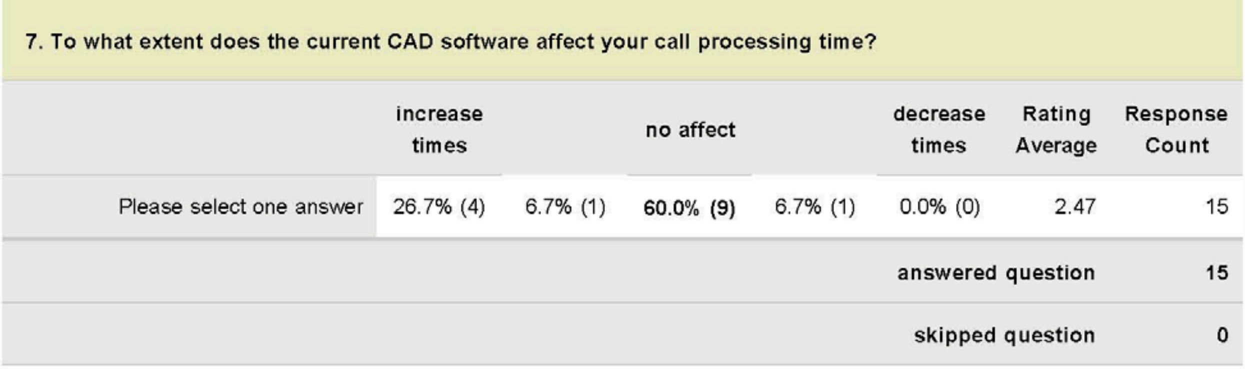
	not familiar at all		somewhat familiar		very familiar	Rating Average	Response Count
Please select one answer	6.7% (1)	13.3% (2)	**33.3% (5)**	26.7% (4)	20.0% (3)	3.40	15
						answered question	**15**
						skipped question	**0**

5. To what extent do the current procedures affect your call processing time?

	increase times		no affect		decrease times	Rating Average	Response Count
Please select one answer	20.0% (3)	6.7% (1)	**60.0% (9)**	6.7% (1)	6.7% (1)	2.73	15
						answered question	**15**
						skipped question	**0**

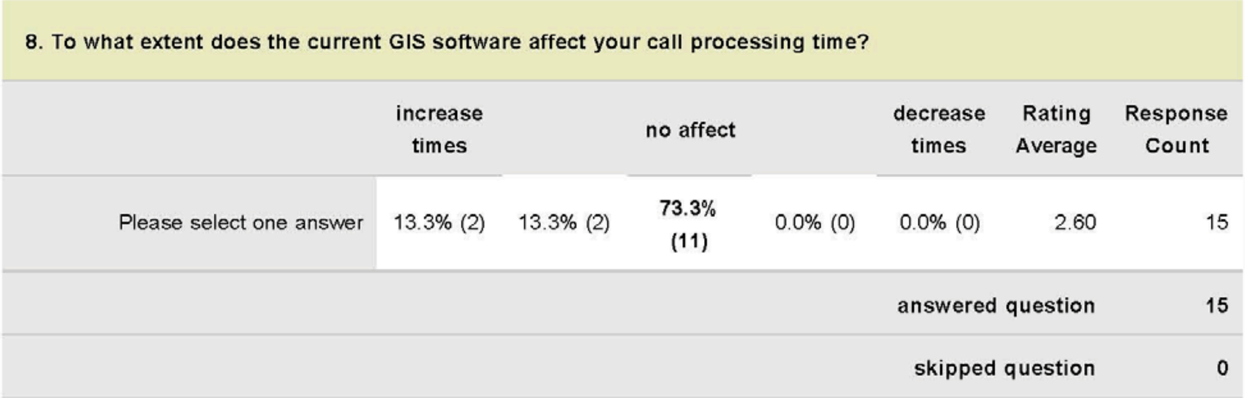
6. To what extent does the current console configuration affect your call processing time?

	increase times		no affect		decrease times	Rating Average	Response Count
Please select one answer	6.7% (1)	6.7% (1)	**66.7% (10)**	20.0% (3)	0.0% (0)	3.00	15
						answered question	**15**
						skipped question	**0**



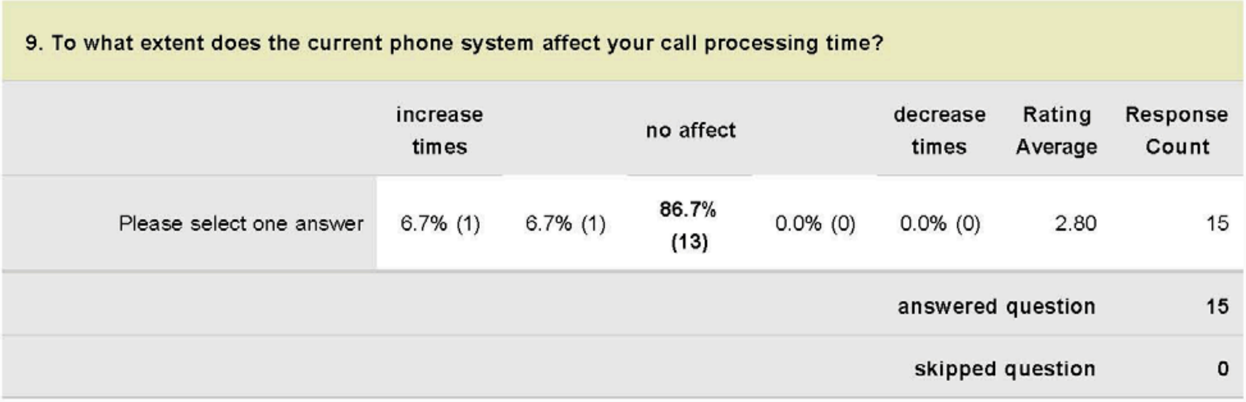
7. To what extent does the current CAD software affect your call processing time?

	increase times		no affect		decrease times	Rating Average	Response Count
Please select one answer	26.7% (4)	6.7% (1)	**60.0% (9)**	6.7% (1)	0.0% (0)	2.47	15
						answered question	**15**
						skipped question	**0**



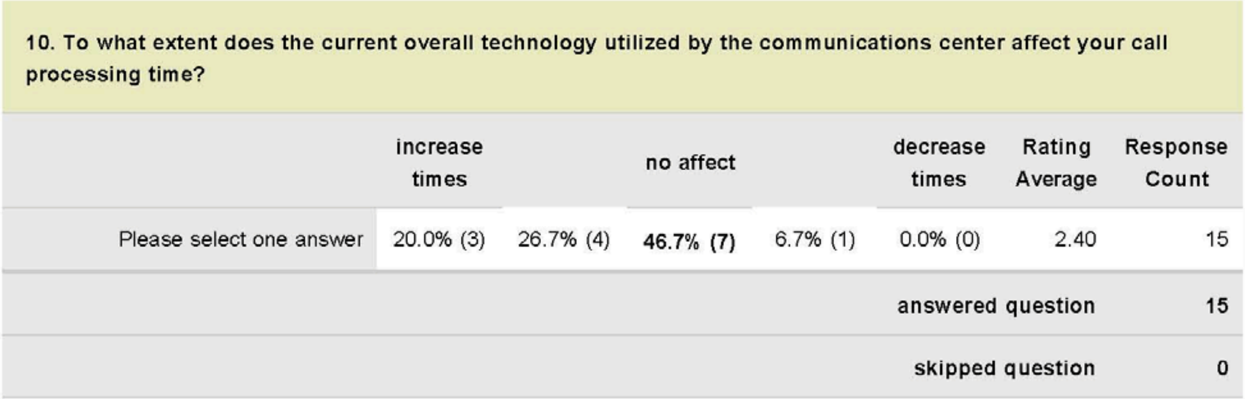
8. To what extent does the current GIS software affect your call processing time?

	increase times		no affect		decrease times	Rating Average	Response Count
Please select one answer	13.3% (2)	13.3% (2)	**73.3% (11)**	0.0% (0)	0.0% (0)	2.60	15
						answered question	**15**
						skipped question	**0**



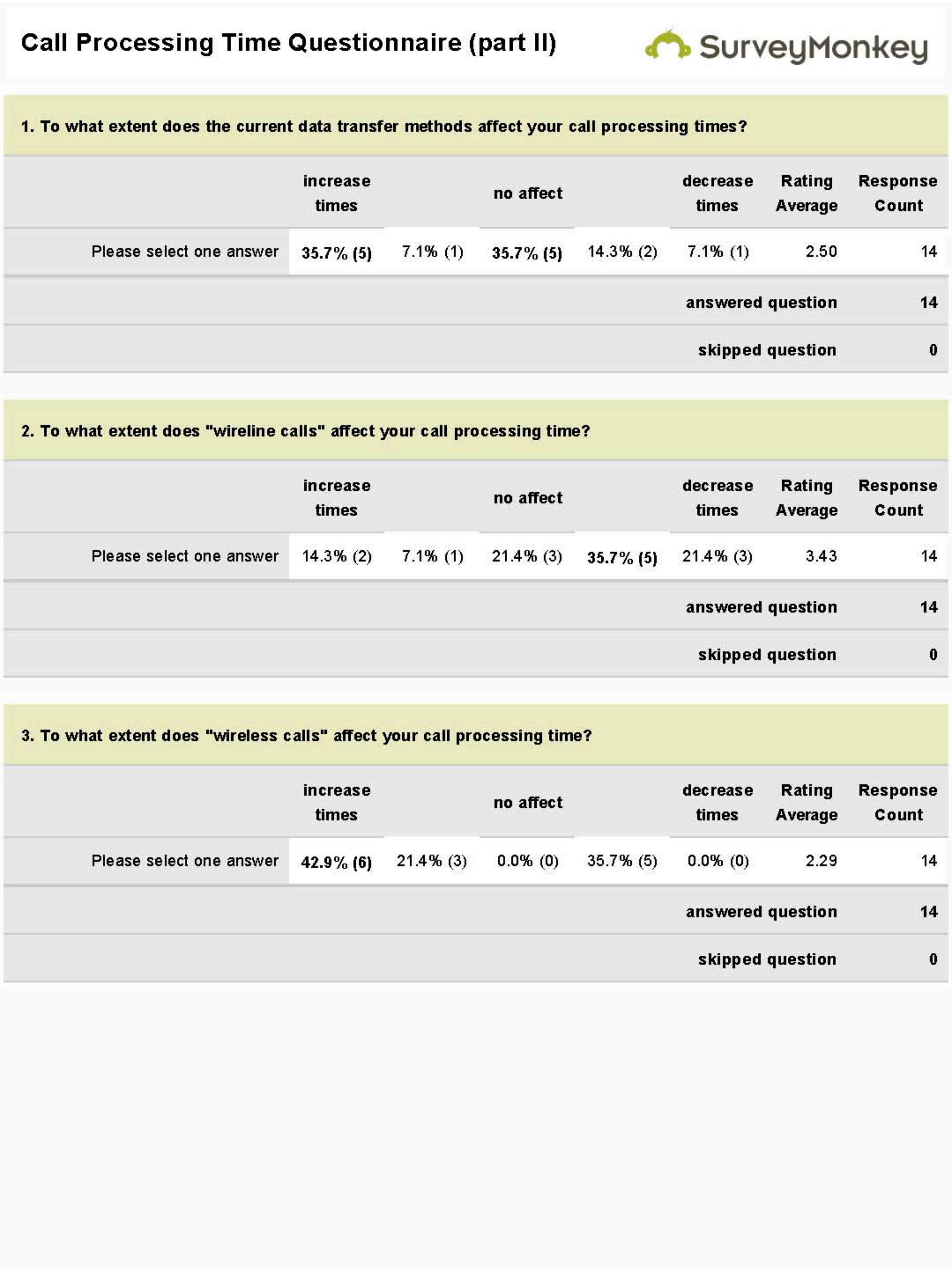
9. To what extent does the current phone system affect your call processing time?

	increase times		no affect		decrease times	Rating Average	Response Count
Please select one answer	6.7% (1)	6.7% (1)	**86.7% (13)**	0.0% (0)	0.0% (0)	2.80	15
						answered question	**15**
						skipped question	**0**



10. To what extent does the current overall technology utilized by the communications center affect your call processing time?

	increase times		no affect		decrease times	Rating Average	Response Count
Please select one answer	20.0% (3)	26.7% (4)	**46.7% (7)**	6.7% (1)	0.0% (0)	2.40	15
						answered question	**15**
						skipped question	**0**



Call Processing Time Questionnaire (part II)

1. To what extent does the current data transfer methods affect your call processing times?

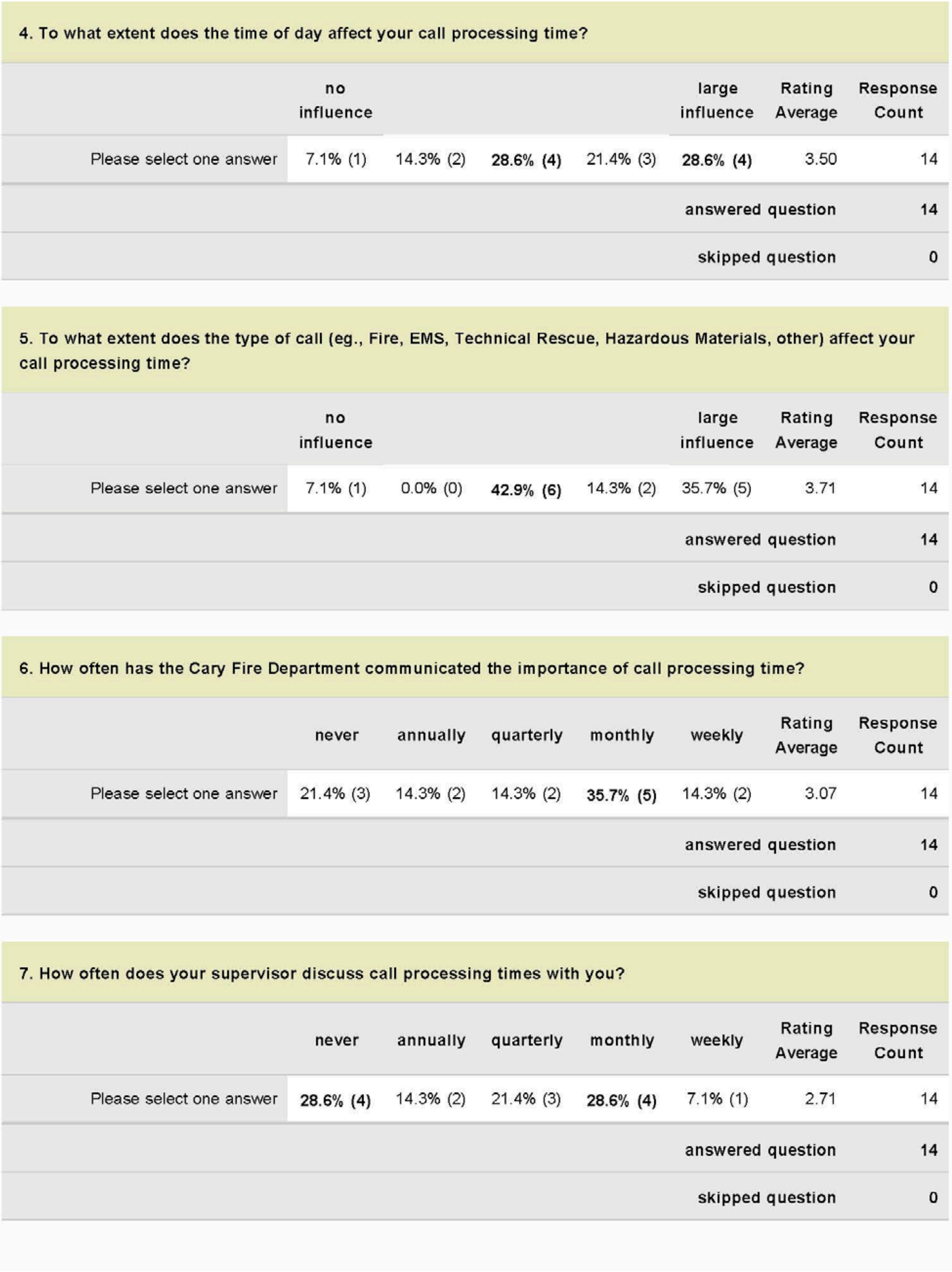
	increase times		no affect		decrease times	Rating Average	Response Count
Please select one answer	**35.7% (5)**	7.1% (1)	**35.7% (5)**	14.3% (2)	7.1% (1)	2.50	14
						answered question	**14**
						skipped question	**0**

2. To what extent does "wireline calls" affect your call processing time?

	increase times		no affect		decrease times	Rating Average	Response Count
Please select one answer	14.3% (2)	7.1% (1)	21.4% (3)	**35.7% (5)**	21.4% (3)	3.43	14
						answered question	**14**
						skipped question	**0**

3. To what extent does "wireless calls" affect your call processing time?

	increase times		no affect		decrease times	Rating Average	Response Count
Please select one answer	**42.9% (6)**	21.4% (3)	0.0% (0)	35.7% (5)	0.0% (0)	2.29	14
						answered question	**14**
						skipped question	**0**



4. To what extent does the time of day affect your call processing time?

	no influence				large influence	Rating Average	Response Count
Please select one answer	7.1% (1)	14.3% (2)	**28.6% (4)**	21.4% (3)	**28.6% (4)**	3.50	14
						answered question	**14**
						skipped question	**0**

5. To what extent does the type of call (eg., Fire, EMS, Technical Rescue, Hazardous Materials, other) affect your call processing time?

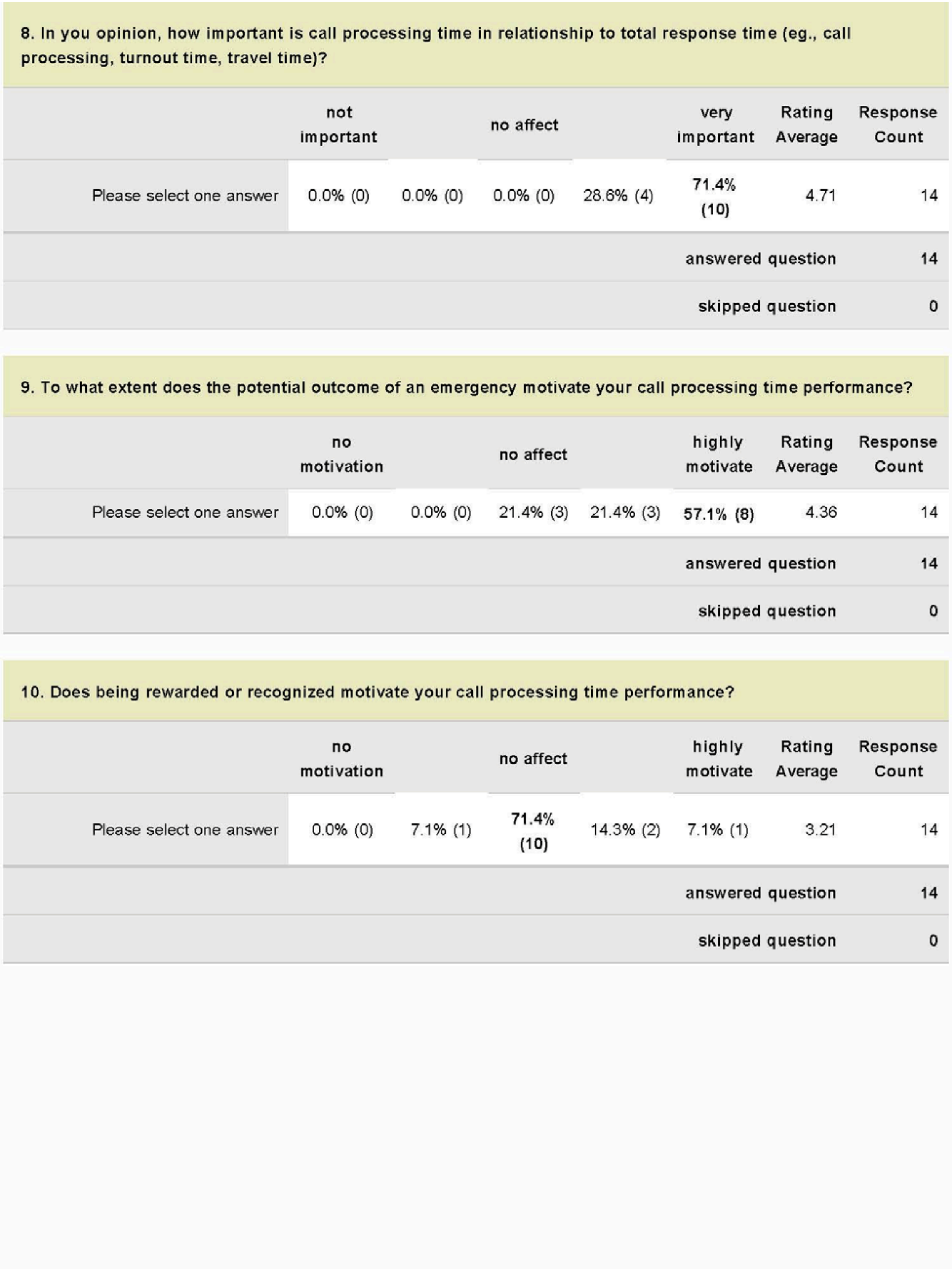
	no influence				large influence	Rating Average	Response Count
Please select one answer	7.1% (1)	0.0% (0)	**42.9% (6)**	14.3% (2)	35.7% (5)	3.71	14
						answered question	**14**
						skipped question	**0**

6. How often has the Cary Fire Department communicated the importance of call processing time?

	never	annually	quarterly	monthly	weekly	Rating Average	Response Count
Please select one answer	21.4% (3)	14.3% (2)	14.3% (2)	**35.7% (5)**	14.3% (2)	3.07	14
						answered question	**14**
						skipped question	**0**

7. How often does your supervisor discuss call processing times with you?

	never	annually	quarterly	monthly	weekly	Rating Average	Response Count
Please select one answer	**28.6% (4)**	14.3% (2)	21.4% (3)	**28.6% (4)**	7.1% (1)	2.71	14
						answered question	**14**
						skipped question	**0**



8. In you opinion, how important is call processing time in relationship to total response time (eg., call processing, turnout time, travel time)?

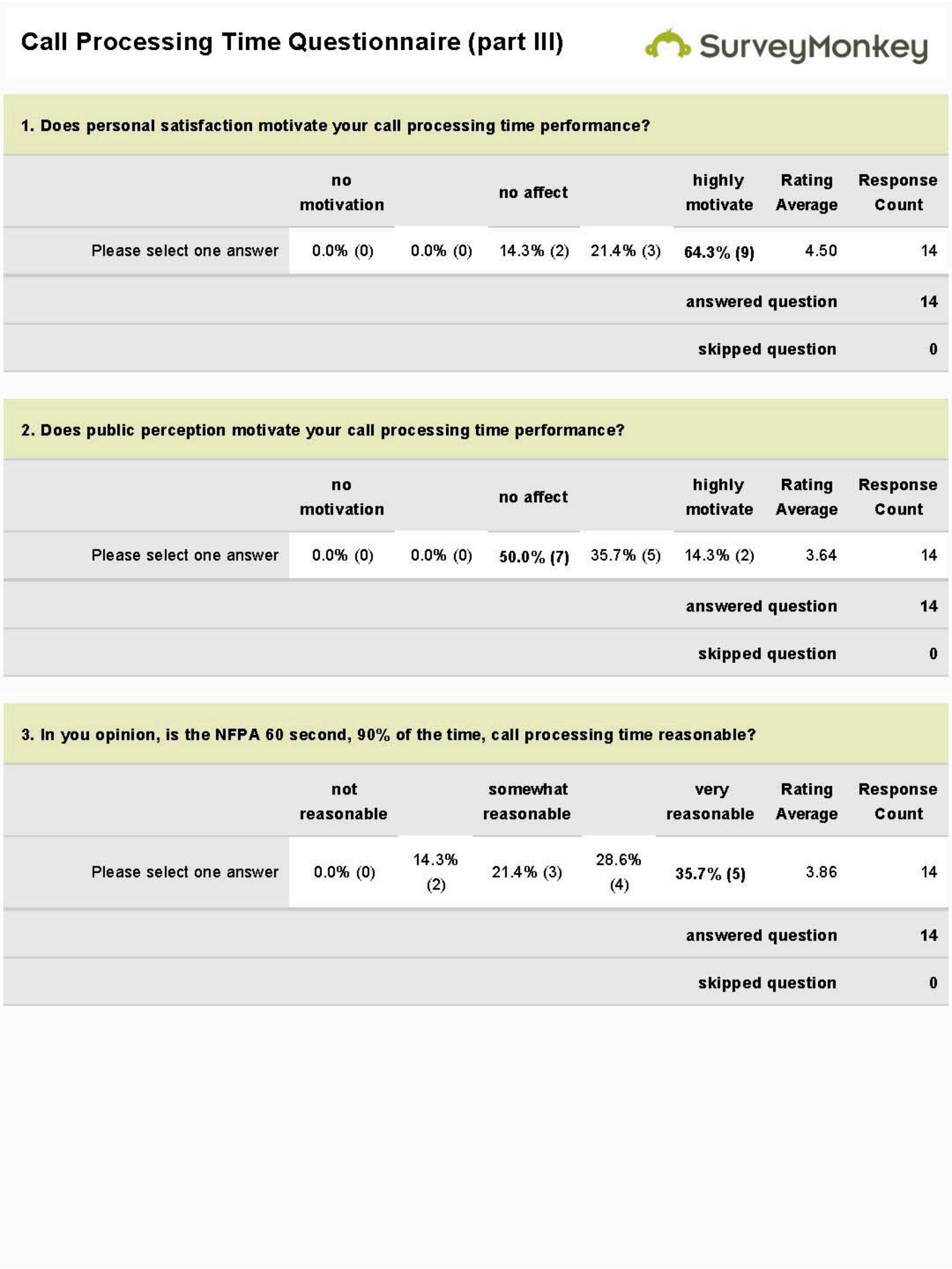
	not important		no affect		very important	Rating Average	Response Count
Please select one answer	0.0% (0)	0.0% (0)	0.0% (0)	28.6% (4)	**71.4% (10)**	4.71	14
					answered question		**14**
					skipped question		**0**

9. To what extent does the potential outcome of an emergency motivate your call processing time performance?

	no motivation		no affect		highly motivate	Rating Average	Response Count
Please select one answer	0.0% (0)	0.0% (0)	21.4% (3)	21.4% (3)	**57.1% (8)**	4.36	14
					answered question		**14**
					skipped question		**0**

10. Does being rewarded or recognized motivate your call processing time performance?

	no motivation		no affect		highly motivate	Rating Average	Response Count
Please select one answer	0.0% (0)	7.1% (1)	**71.4% (10)**	14.3% (2)	7.1% (1)	3.21	14
					answered question		**14**
					skipped question		**0**



Call Processing Time Questionnaire (part III)

1. Does personal satisfaction motivate your call processing time performance?

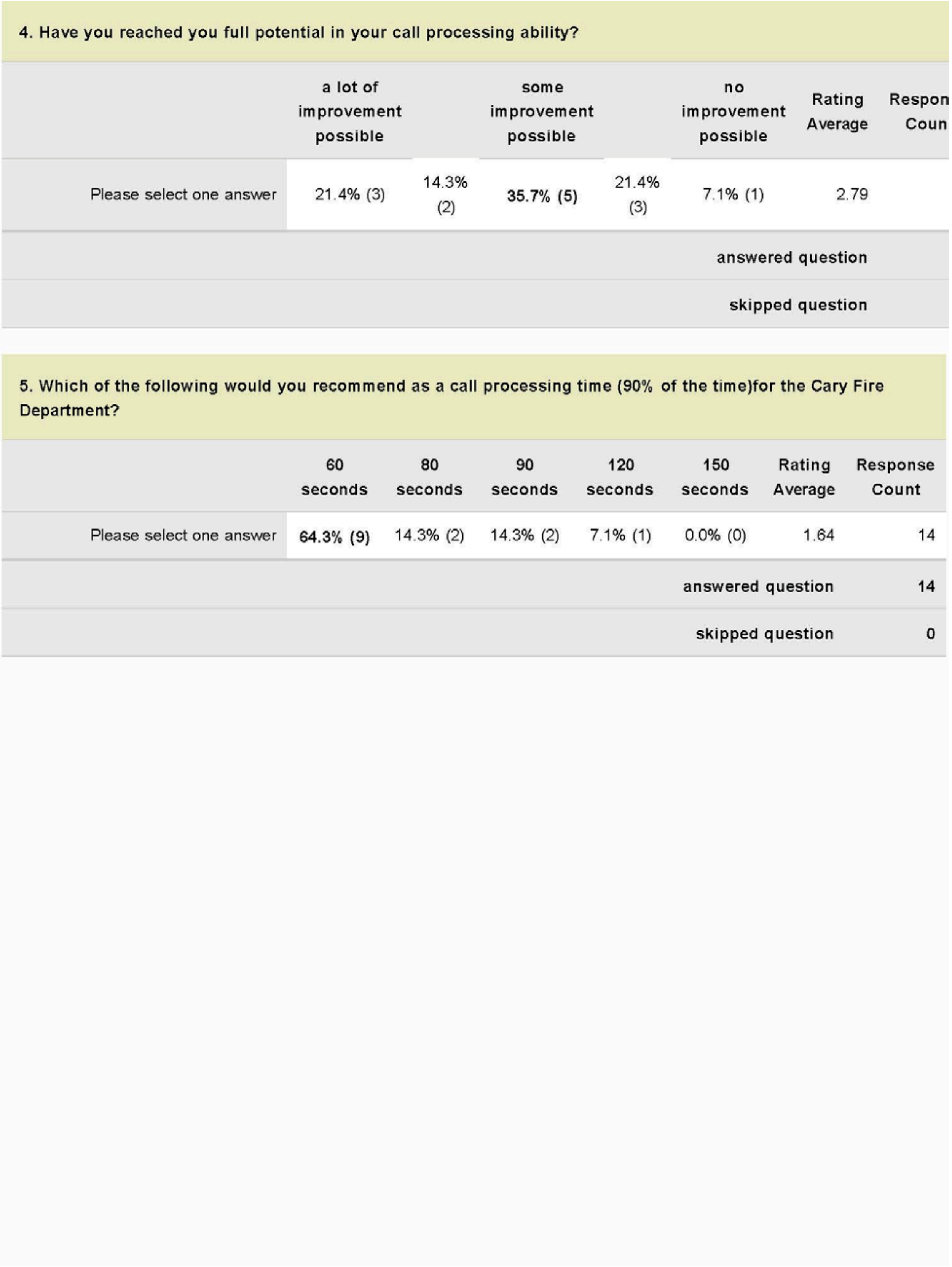
	no motivation		no affect		highly motivate	Rating Average	Response Count
Please select one answer	0.0% (0)	0.0% (0)	14.3% (2)	21.4% (3)	**64.3% (9)**	4.50	14
						answered question	**14**
						skipped question	**0**

2. Does public perception motivate your call processing time performance?

	no motivation		no affect		highly motivate	Rating Average	Response Count
Please select one answer	0.0% (0)	0.0% (0)	**50.0% (7)**	35.7% (5)	14.3% (2)	3.64	14
						answered question	**14**
						skipped question	**0**

3. In you opinion, is the NFPA 60 second, 90% of the time, call processing time reasonable?

	not reasonable		somewhat reasonable		very reasonable	Rating Average	Response Count
Please select one answer	0.0% (0)	14.3% (2)	21.4% (3)	28.6% (4)	**35.7% (5)**	3.86	14
						answered question	**14**
						skipped question	**0**



4. Have you reached you full potential in your call processing ability?

	a lot of improvement possible		some improvement possible		no improvement possible	Rating Average	Respon Coun
Please select one answer	21.4% (3)	14.3% (2)	**35.7% (5)**	21.4% (3)	7.1% (1)	2.79	
						answered question	
						skipped question	

5. Which of the following would you recommend as a call processing time (90% of the time)for the Cary Fire Department?

	60 seconds	80 seconds	90 seconds	120 seconds	150 seconds	Rating Average	Response Count
Please select one answer	**64.3% (9)**	14.3% (2)	14.3% (2)	7.1% (1)	0.0% (0)	1.64	14
						answered question	**14**
						skipped question	**0**